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## UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR § 1.53(b))

Attorney Docket No.	0666.023000E/TGD/ALF
First Inventor or Application Identifier	Hideaki Okada
Title	Axle Driving Apparatus
Express Mail Label No.	

## APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

ADDRESS TO: Assistant Commissioner for Patents  
Box Patent Application  
Washington, DC 20231

1. ☒ \* Fee Transmittal Form (e.g., PTO/SB/17)  
(Submit an original, and a duplicate for fee processing)
2. ☒ Specification [Total Pages 21 ]  
(preferred arrangement set forth below)  
- Descriptive title of the invention  
- Cross References to Related Applications  
- Statement Regarding Fed sponsored R & D  
- Reference to Microfiche Appendix  
- Background of the Invention  
- Brief Summary of the Invention  
- Brief Description of the Drawings (if filed)  
- Detailed Description  
- Claim(s)  
- Abstract of the Disclosure
3. ☒ Drawing(s) (35 U.S.C. 113) [Total Sheets 14 ]
4. ☒ Oath or Declaration [Total Pages 4 ]
- a. ☐ Newly executed (original or copy)
- b. ☒ Copy from a prior application (37 CFR 1.63(d)) (for continuation/divisional with Box 17 completed)  
[Note Box 5 below]
- i. ☐ DELETION OF INVENTOR(S)  
Signed statement attached deleting inventor(s) named in the prior application, see 37 CFR §§ 1.63(d)(2) and 1.33(b).
5. ☒ Incorporation By Reference (useful if Box 4b is checked)  
The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.

6. ☐ Microfiche Computer Program (Appendix)
7. Nucleotide and/or Amino Acid Sequence Submission (if applicable, all necessary)
- a. ☐ Computer Readable Copy
- b. ☐ Paper Copy (identical to computer copy)
- c. ☐ Statement verifying identity of above copies

## ACCOMPANYING APPLICATION PARTS

8. ☐ Assignment Papers (cover sheet & document(s))
9. ☐ 37 CFR 3.73(b) Statement (when there is an assignee) ☐ Power of Attorney
10. ☐ English Translation Document (if applicable)
11. ☐ Information Disclosure Statement (IDS)/PTO-1449 ☐ Copies of IDS Citations
12. ☒ Preliminary Amendment
13. ☒ Two Return Receipt Postcards (MPEP 503) (Should be specifically itemized)
14. ☐ \*Small Entity Statement(s) (PTO/SB/09-12) ☐ Statement filed in prior application, Status still proper and desired
15. ☐ Certified Copy of Priority Document(s) (if foreign priority is claimed)
16. ☒ Other 37 C.F.R. § 1.136(a)(3) Authorization
- ☐ Other
- \*NOTE FOR ITEMS 1 & 14: IN ORDER TO BE ENTITLED TO PAY SMALL ENTITY FEES, A SMALL ENTITY STATEMENT IS REQUIRED (37 C.F.R. § 1.27), EXCEPT IF ONE FILED IN A PRIOR APPLICATION IS RELIED UPON (37 C.F.R. § 1.28).

17. If a CONTINUING APPLICATION, check appropriate box, and supply the requisite information below and in a preliminary amendment:

☒ Continuation ☐ Divisional ☐ Continuation-in-Part (CIP) of prior application No: 08/818,964Prior application information: Examiner D. Depumpe Group/Art Unit: 3018

## 18. CORRESPONDENCE ADDRESS

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or Bar Code Label

(Insert Customer No. or Attach bar code label here)

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SIGNATURE		Date	December 29, 1999

Burden Hour Statement: This form is estimated to take 2 hours to complete. Time will vary depending upon the needs of the individual case. Any comments on the amount of time you are required to complete this form should be sent to the Chief Information Officer, Patent and Trademark Office, Washington, DC 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Assistant Commissioner for Patents, Washington, DC 20231

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December 29, 1999

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**Box Patent Application**

Re: U.S. Non-Provisional Utility Patent Application under 37 C.F.R. § 1.53(b)  
Appl. No. To be assigned; Filed: Herewith  
For: **Axle Driving Apparatus**  
Inventors: Okada *et al.*  
Our Ref: 0666.023000E/TGD/ALF

Sir:

The following documents are forwarded herewith for appropriate action by the U.S. Patent and Trademark Office:

1. PTO Utility Patent Application Transmittal Form (PTO/SB/05);
2. U.S. Utility Patent Application entitled:

**Axle Driving Apparatus**

and naming as inventors:

Hideaki Okada  
Shusuke Nemoto

PTO  
1551 U.S. 1551  
09/474127  
12/29/99

JC639 U.S. PTO  
12/29/99  
12/29/99

Assistant Commissioner for Patents  
December 29, 1999  
Page 2

the application consisting of:

- a. A specification containing:
    - (i) 17 pages of description prior to the claims;
    - (ii) 3 pages of claims (6 claims);
    - (iii) a one (1) page abstract;
  - b. 14 sheets of drawings: (Figures 1 to 16);
  - c. A copy of the inventor signed Declaration and Power of Attorney, as filed in U.S. Appl. No. 07/304,581;
3. PTO Fee Transmittal Form PTO/SB/17;
  4. A Preliminary Amendment;
  5. Authorization to Treat a Reply As Incorporating An Extension of Time Under 37 C.F.R. § 1.136(a)(3);
  6. Our check No. 26325 for \$690.00 to cover the filing fee; and
  7. Two (2) return postcards.

It is respectfully requested that, of the two attached postcards, one be stamped with the filing date of these documents and returned to our courier, and the other, prepaid postcard, be stamped with the filing date and unofficial application number and returned as soon as possible.

Figure 1. Schematic representation of the experimental design. The first part of the experiment consisted of a familiarization phase, followed by a training phase and a test phase. The training phase was divided into two parts: a pre-training phase and a training phase. The pre-training phase consisted of a pre-training session and a pre-training session. The training phase consisted of a training session and a training session. The test phase consisted of a test session and a test session.

Respectfully submitted,

Mary Quinn

Enclosures

TGD/ALF:vrh  
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SKGF ver. 11/9/99 mac

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

Okada *et al.*

Appl. No. To be Assigned

(Continuation of U.S. Appl. No. 08/818,964; Filed:  
March 14, 1997)

Filed: Herewith

For: **Axle Driving Apparatus**

Art Unit: To be Assigned

Examiner: To be Assigned

Atty. Docket: 0666.023000E/TGD/ALF

**Preliminary Amendment**

Assistant Commissioner for Patents  
Washington, D.C. 20231

Sir:

Please enter the following amendment into the application prior to the examination thereof.

Please amend the captioned application as follows:

***In the Claims:***

Please cancel claims 1-6 without prejudice to or disclaimer of the subject matter contained therein. Please add the following new claim:

-- 7. An axle driving apparatus comprising:

a housing;

a hydrostatic transmission disposed within said housing, said hydrostatic transmission including a hydraulic pump and a hydraulic motor, said hydraulic motor including an output shaft;

a pair of axles disposed within said housing;

a pair of bevel gears, one disposed on each axle of said pair of axles;

a ring gear coupled to said output shaft of said hydraulic motor; and  
a pair of pinion gears disposed within said ring gear and coupled to said pair of bevel  
gears, whereby said ring gear is supported within said housing by said pair of axles.--

**Remarks**

Upon entry of the foregoing amendment, independent claim 7 is the only claim pending in the application. Claims 1-6 are cancelled without prejudice to or disclaimer of the subject matter therein. New claim 7 is added. The subject matter of new claim 7 is contained in the application as originally filed. Accordingly, the foregoing amendment does not introduce new matter and its entry is respectfully requested.

If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at the number provided.

Respectfully submitted,

STERNE, KESSLER, GOLDSTEIN & FOX P.L.L.C.



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Date: December 29, 1999

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## SPECIFICATION

### 1. Title of the Invention

Axle Driving Apparatus

### 2. Field of the Invention

The present invention relates to an axle driving apparatus with a hydro-static-transmission used as a driving apparatus for a light tractor.

### 3. Background of the Invention

Conventionally, an axle driving apparatus, which vertically divides a casing thereof and journals axles at the divided surfaces and drives the axles by a hydro-static-transmission attached to the casing, is well known as disclosed in, for example, the Japanese Utility Model Publication Gazette No. Sho 62-44198 and the Japanese Patent Laid-Open Gazette Sho 62-101945, filed by the same applicant.

In the conventional prior art, however, the hydro-static-transmission separate from the axle driving apparatus is fixed to the outside thereof in a manner of being exposed, whereby the apparatus is large-sized as a whole and larger in the gross weight. Also, it is required for driving the horizontally disposed axles by a motor shaft of a hydraulic motor vertically disposed at the exterior to interpose bevel gears in a drive system for both

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the motor shaft and axles.

#### 4. Summary of the Invention

An object of the invention is to provide an axle driving apparatus which contains the hydraulic motor and a hydraulic pump at the hydro-static-transmission in a transmission casing of the axle driving apparatus and a center section for connecting the hydraulic motor and hydraulic pump is disposed in the transmission casing, the center section being fixed to the butt joint surface thereof.

The center section is formed in a L-like shape when viewed in section and an oil passage from the hydraulic pump to the hydraulic motor is bent at a right angle to thereby extend the motor shaft in parallel to the axle. Hence, instead of conventional bevel gears used to turn the rotation direction, the oil passage in the center section is used to turn the power transmitting direction.

In a case where the center section is fixed to the butt joint surfaces to the half casings, when the half casings are fixedly jointed directly with aluminum die casting by use of four bolts, the center section may be distorted, thereby using three tightening bolts.

The above and further objects and novel features

of the invention will more fully appear from the following detailed description when the same is read in connection with the accompanying drawings.

#### 5. Brief Description of the Drawings

Fig. 1 is a side view of a light tractor attached with an axle driving apparatus of the invention,

Fig. 2 is a sectional front view thereof,

Fig. 3 is a sectional view taken on the line I-I in Fig. 2, in which an upper half casing is removed,

Fig. 4 is a sectional view taken on the line V-V in Fig. 3,

Fig. 5 is a sectional view taken on the line VI-VI in Fig. 3,

Fig. 6 is a sectional view taken on the line II-II in Fig. 3,

Fig. 7 is a sectional front view of a modified embodiment of the axle driving apparatus of the invention, in which check valves are changed in arrangement thereof,

Fig. 8 is a plan view of the same,

Fig. 9 is a sectional view taken on the line III-III in Fig. 7,

Fig. 10 is a sectional view taken on the line

IV-IV in Fig.7 ,

Fig. 11 is a perspective exploded view of the axle driving apparatus of the invention,

Fig. 12 is a sectional front view of another modified embodiment of the invention, in which a center section is fixed to the inner surface of the bottom wall of a lower half casing,

Fig. 13 is a plan view of the Fig. 12 embodiment,

Fig. 14 is a sectional front view of a further modified embodiment of the invention, in which a center section has three bolt-bores into which three fixing bolts are inserted so that the center section is fixed therethrough to the upper half casing,

Fig. 15 is a plan view of the Fig. 14 embodiment, and

Fig. 16 is a sectional plan view of the center section.

#### 6. Description of the Preferred Embodiments

Referring to Fig. 1, a light tractor loading thereon an engine E of a vertical crank shaft is shown.

A pulley is fixed to the vertical crank shaft of the engine so that a driving power is transmitted

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from the pulley through a belt to a pulley fixed to a pump shaft 4 of a hydraulic pump P projecting upwardly from an axle driving apparatus of the invention.

The tractor is provided at the front or under the body with a mower R or R' to thereby mow a lawn.

The present invention relates to the axle driving apparatus for driving axles 13 at the tractor.

Next, the axle driving apparatus will be detailed of its construction in accordance with Figs. 1 through 6.

A transmission casing of the axle driving apparatus is formed in upper and lower half casings 1 and 2, both the casings being jointed to form one closed-type transmission casing.

Between the butt joint surfaces of the upper and lower half casings 1 and 2 are held bearings to the axles 13 and a counter shaft 24 and a bearing 34 for one end of a motor shaft 5.

At the lower surface of the upper half casing 1 is formed a mounting surface so that a center section 3 fixedly supporting the hydraulic pump P and a hydraulic motor M is mountable to the mounting surface through bolts 39 inserted into bolt holes 3g from below.

In the state where the center section 3 fixing thereto the hydraulic motor M and hydraulic pump P is mounted to the lower surface of the upper half casing 1, the lower half casing 2 is jointed from below with the lower surface of the upper half casing 1 in a manner of closing the lower half casing 2 and bolts are used to connect both the upper and lower half casings 1 and 2.

The upper and lower half casings 1 and 2 are formed by aluminum die casting, whereby parts subjected to mechanical processing are reduced to lower the manufacturing cost.

The HST type transmission stored within the axle driving apparatus comprises the hydraulic pump P, center section 3 and hydraulic motor M, so that a pump mounting surface 3d and a motor mounting surface 3e are formed in the plane perpendicular to the center section 3.

Pairs of crescent-shaped oil passages 3a' and 3b' and 3a" and 3b" are formed at the pump mounting surface 3d and motor mounting surface 3e, the pair of crescent-shaped oil passages 3a" and 3b" at the motor mounting surface 3e and pair of crescent-shaped oil passages 3a' and 3b' at the pump mounting surface 3d being connected to two oil passages 3a

and 3b to constitute a closed circuit.

A cylinder block 10 for the hydraulic pump P is rotatably mounted on the pump mounting surface 3d and pistons 12 are inserted vertically slidably into a plurality of piston holes at the cylinder block 10 respectively.

When the pump shaft 4 supported by a bearing 31 at the upper half casing 1 and a spherical bush 32 at the pump mounting surface 3d is rotated, the cylinder block 10 and pistons 12 rotate.

A thrust bearing 15 abutting against the upper end of each piston is changed at an angle by a swash plate 9, so that the discharge rate and discharge direction of the hydraulic pump P are changed to supply the discharged pressure oil from the oil passages 3a' and 3b' at the center section 3 to the hydraulic motor M through the oil passages 3a and 3b.

As shown in Fig. 4, the swash plate 9 is changeable of its angle through a positioning plate 6a in association with rotation of a speed change lever shaft 6, a detent unit 20 for holding the neutral position of the speed change lever shaft 6 being constituted in the upper half casing 1.

The detent unit 20 is fitted into a recess 6b at the positioning plate 6a, thereby enabling the

neutral position to be ensured.

As shown in Figs. 2 and 3, a short-circuit valve 25 of slidable selector valve for short-circuiting between the two oil passages 3a and 3b at the discharge side and the return side is disposed, so that when the valve 25 is changed over to haul the body of tractor, generation of the state where the hydraulic motor M side is driven to send the pressure oil toward the hydraulic pump side can be avoided.

Reference numeral 7 designates a control for operating the short-circuit valve 25.

The short-circuit valve 25 and control 7 are slidably operated to push to be disengageable or pull without engagement in order to be controllable in the abutting condition. Such construction enables simple assembly of the apparatus.

Between the oil passages 3a and 3b at the center section 3 are interposed check valves 26 and 27 to form an oil feed route 30, and between the check valves 26 and 27 is bored an operating oil suction port 3c extending downwardly.

In the lower end of operating oil suction port 3c is fitted an oil filter 8 formed of a spongy fine-porous material, the oil filter 8 contacting

with the lower half casing 2 so as to be held thereto.

Thus, the oil filter 8, operating oil suction port 3c and check valves 26 and 27 are provided to communicate with the oil passages 3a and 3b through the check valves 26 and 27, whereby in a case where the hydraulic motor M and hydraulic pump P operate and the operating oil leaks from the interior of the closed circuit so as to decrease, the oil passage 3a or 3b generates therein negative pressure so that lubricating oil in the casing is taken in as the operating oil.

In addition, reference numeral O designates an oil level of lubricating oil filled into the transmission casing.

The pump mounting surface 3d at the center section 3 is somewhat larger in its flat surface to also serve as the surface through which the center section 3 is mounted to the lower surface of the upper half casing 1.

A cylinder block 11 is rotatably mounted onto the motor mounting surface 3e at the center section 3, and pistons 14 are slidably fitted into a plurality of piston holes at the cylinder block 11 and always abut at the heads against a thrust bearing 16. In such construction, the pistons 14 push the thrust

bearing 16 through the pressure oil from the oil passages 3a and 3b and slide down at the heads along the slanted surface of the thrust bearing so as to generate a torque, thereby rotating the cylinder block 11 and motor shaft 5.

The thrust bearing 16 is supported by an annular support 35 in relation of being slanted at a predetermined angle, the annular support 35 being fixedly sandwiched between the upper and lower half casings 1 and 2.

The motor shaft 5 is provided at one axial end journaled to the center section 3 with a spherical bush 33 and at the other end with a spherical bush 34, which are sandwiched between the upper and lower half casings 1 and 2.

A gear 17 is mounted on the motor shaft 5 and engages with a gear 21 on the counter shaft 24, the gears 17 and 21 constituting the first deceleration means.

A small diameter gear 22 on the counter shaft 24 engages with a ring gear 23 at a differential gear unit D, which gives differential rotations to drive the axles 13.

The small diameter gear 22 and ring gear 23 constitute the second deceleration means.

A brake drum 18 is fixed to the foremost end of the motor shaft 5 and brake shoes are expanded radially outwardly by a brake lever 19 to contact with the brake drum 18, thereby exerting the braking action.

In Fig. 6, part of motor mounting surface 3e, against which the motor casing 11 for the hydraulic motor M abuts, is shown.

Referring to Figs. 7, 8, 9 and 10, a modified embodiment of the axle driving apparatus of the invention will be described.

In the embodiment shown in Figs. 2 and 3, the oil passages 3a and 3b and supply oil passage 30 are provided at the same plane, but in this case, the motor mounting surface 3e must separate with respect to the pump mounting surface 3d, whereby the center section 3 cannot be compact to that extent and also the casing becomes larger.

Therefore, in the embodiment shown in Figs. 7 through 10, in order to eliminate the above defects, the supply oil passage 30 is disposed to overlap with the oil passages 3a and 3b in a range of thickness of the lower portion of the center section 3 and below the oil passages 3a and 3b.

The supply oil passage 30 is bored to communicate

at the upper half thereof with the lower halves in a manner of overlapping therewith. Hence, the oil passage connecting both the oil passages 30 and 3a, 3b is not required, thereby enabling the center section 3 to be made as smaller as possible in thickness.

At the center of the supply oil passage 30 is open an operating oil suction port 3c toward an oil filter 8 positioned below, and check valves 26 and 27 for opening or closing the communicating portion between the oil passages 3a and 3b are interposed in the supply oil passage 30 in relation of putting the operating oil suction port 3c between the check valves 26 and 27. Supply oil from the operating oil suction port 3c flows to the oil passages 3a and 3b through the portion at the supply oil passage 30 where the supply oil passes the check valves 26 and 27.

Thus, within the center section 3, the oil passages 3a and 3b, supply oil passage 30 and oil filter 8 overlap with each other, whereby the motor mounting surface 3e can approach the pump mounting surface 3d so as to enable the center section 3 to be compact.

Next, explanation will be given on the embodiment

in Figs. 12 and 13.

In this embodiment, a center section 3 abuts from above against the inner surface of the bottom wall of the lower half casing 2 and is fixed thereto.

Bolts 39 for fixing the center section 3 also are inserted from above into the bolt bores and screw with the lower half casing 2 respectively.

The center section 3 in this embodiment, as shown in Fig. 12, is about L-like-shaped when viewed in section from the rear surface.

Other constructions are about the same as the aforesaid embodiment.

Next, explanation will be given on the embodiment in Figs. 14, 15 and 16.

In this embodiment, three bolt bores 3g for three bolts 39 for fixing the center section 3 to the lower surface of the upper half casing 1 are provided at the center section 3, the three bolts 39 fixing the center section 3 to the upper half casing 1.

The center section 3 and upper half casing 1 constitute material with aluminum die casting, the mounting surfaces of both the members being not applied with machining.

Hence, when four bolts 39 are used to fix the

center section 3, an error in material may distort the same to worsen the tight condition.

In such case, three bolts 39 are inserted into three bolt bores 3g to fix the center section 3, thereby keeping all the bolts in good tight conditions.

In the embodiment in Figs. 14, 15 and 16, the pump mounting surface 3d is not adjacent to the motor mounting surface 3e at the center section 3, but near the axle 13.

Oil passages 3a and 3b are bored from a pair of crescent-shaped oil passages provided at the motor mounting surface 3e and extend in parallel to the axles 13, oil passages 3m and 3n being bored from a pair of crescent-shaped oil passages and extending perpendicularly to the axles 13, so that both oil passages 3m and 3a and 3n and 3b communicating with each other in the center section 3.

The open ends of oil passages 3m and 3n are plugged and the plugs are locked by projections formed at the bottom of the lower half casing 2 respectively.

Check valves 36 and 37 are provided at open ends of oil passages 3a and 3b, valve levers 36b and 37b of which are connected to a leaf spring 38.

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The valve levers 36b and 37b are open only in the direction of flowing oil from the operating oil suction ports 3p and 3q into the oil passages 3a and 3b, so that the check valves 36 and 37 flowing into the oil passages 3a and 3b the supply operating oil after passing the plate-like oil filter 8 discharges to the exterior the pressure oil in the oil passages 3a and 3b by pushing the valve levers 36b and 37b through the leaf spring 38 pushed by a control 7, thereby serving as the short circuit valves to cause the free condition of hydraulic motor M.

As seen from the above, the center section 3 carrying the hydraulic pump P vertically and the hydraulic motor M horizontally is provided and contained within the transmission casing while carrying both the pump P and motor M, whereby the operating oil, even when leaked from the hydraulic pump P or hydraulic motor M, does not flow out to the exterior. Also, since the oil passages are formed at the center section 3, the piping is not at all required in or out the transmission casing.

The center section 3 is fixed to the upper half casing 1 or the lower half casing 2, thereby being simple to support. Also, the pump shaft 4 and motor

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shaft 5 are simple to support.

The pump mounting surface 3d and motor mounting surface 3e are disposed in an L-like-shape and the center suction 3 is about L-like-shaped when viewed in section, so that the pump shaft 4 of input shaft is vertical and the motor shaft 5 of output shaft is horizontal, thereby making the axle driving apparatus compact without interposing the bevel gears, and the power transmitting direction can be changed at an angle of  $90^{\circ}$ , thereby having advantages for the tractor loading a vertical shaft - output shaft type engine.

The center section 3 is fixed to the lower side of the butt joint surface of the upper half casing 1 so that the pump mounting surface 3d is level with the mounting surface of the center section 3 to the upper half casing, whereby the surfaces of the upper half casing 1, lower half casing 2 and center section 3 can be restricted to a minimum.

Three bores 3g for the three fixing bolts 39 through which the center section 3 is fixed to the lower surface of the upper half casing 1 are formed, so that when the mounting surfaces of center section 3 and of upper half casing 1 are fixed as they are not flattened but cast, there is no fear that a

poor tightening condition is created on the center section 3.

The spherical bush 32 at the pump shaft 4 and spherical bush at the bearing for the motor shaft 5 are used, so that even when the center section 3 is mounted slantwise due to an assembly error or a machining error, a shift of the pump shaft 4 or the motor shaft 5 is absorbable.

Also, the spherical bush is smaller in the size than the usual bearing, whereby the bearing is disposable without interfering with the oil passages bored at the center section.

Although several embodiments have been described, they are merely exemplary of the invention and not to be constructed as limiting, the invention being defined solely by the appended claims.

7. What is claimed is:

1. An axle driving apparatus which contains a hydraulic pump driven by an engine and a hydraulic motor connected in association with axles in a transmission casing supporting left and right axles, characterized in that:

said hydraulic pump is vertically disposed so as to dispose a pump shaft vertically with respect to said axles,

said hydraulic motor is horizontally disposed so as to dispose a motor shaft in parallel to said axles, and

a center section to which said hydraulic pump and hydraulic motor are mountable is fixed in said transmission casing.

2. An axle driving apparatus according to Claim 1, characterized in that:

said transmission casing is divided into two vertical casings,

said pump mounting surface of said center section is disposed in parallel with respect to the divided surface of said transmission casing,

said motor mounting surface is disposed vertically to said divided surface, and

said center section is mounted to one of said

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upper half casing and lower half casing, the axis of said motor shaft is positioned on the dividing line of said transmission casing, and bearings for said motor shaft are held between said upper half casing and said lower half casing.

3. An axle driving apparatus according to Claims 1 and 2, characterized in that said center section is provided at the pump mounting surface thereof with a rotary surface of a pump cylinder block and a bearing for said pump shaft and at said motor mounting surface with a rotary surface of a motor cylinder block and a bearing for said motor shaft, said pump mounting surface and motor mounting surface being disposed in an L-like shape, said center section being constituted to be about L-like-shaped when viewed in section.

4. An axle driving apparatus according to Claim 2, characterized in that said center section is mounted to said upper half casing, the casing mounting portion extending on the same plane as said pump mounting surface at said center section so as to be on the same plane as the butt joint surface of said upper half casing with respect to said lower half casing.

5. An axle driving apparatus according to Claims 1, 2 and 4, characterized in that said center section

is provided at three portions with bolt bores through which bolts are insertable from above respectively, so that said three bolts inserted into said bolt bores fix said center section to the lower surface of said upper half casing.

6. An axle driving apparatus according to Claim 3, characterized in that said bearings for said pump shaft and motor shaft use spherical bushes respectively.

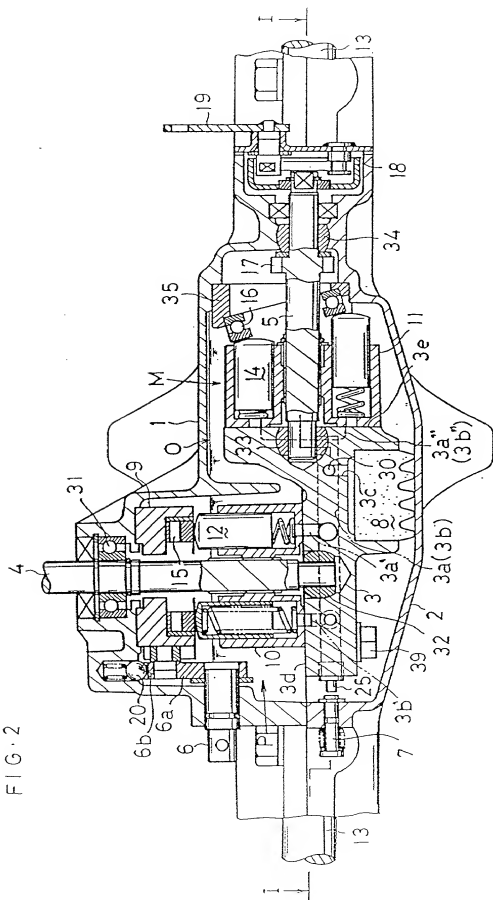
8. Abstract of the Disclosure

SECRET

An axle driving apparatus wherein a hydraulic motor and a hydraulic pump for a hydro-static transmission are housed in a transmission casing of the axle driving apparatus and a center section for connecting the hydraulic motor and hydraulic pump is disposed in the transmission casing, the center section being fixed at the butt joint portion at the transmission casing, and an oil passage from the hydraulic pump to the hydraulic motor at the center section is bent at a right angle so as to extend the motor shaft in parallel to the axles, so that the rotation direction of the motor shaft conventionally changed by bevel gears is changed by the oil passages in the center section.



FIG. 2



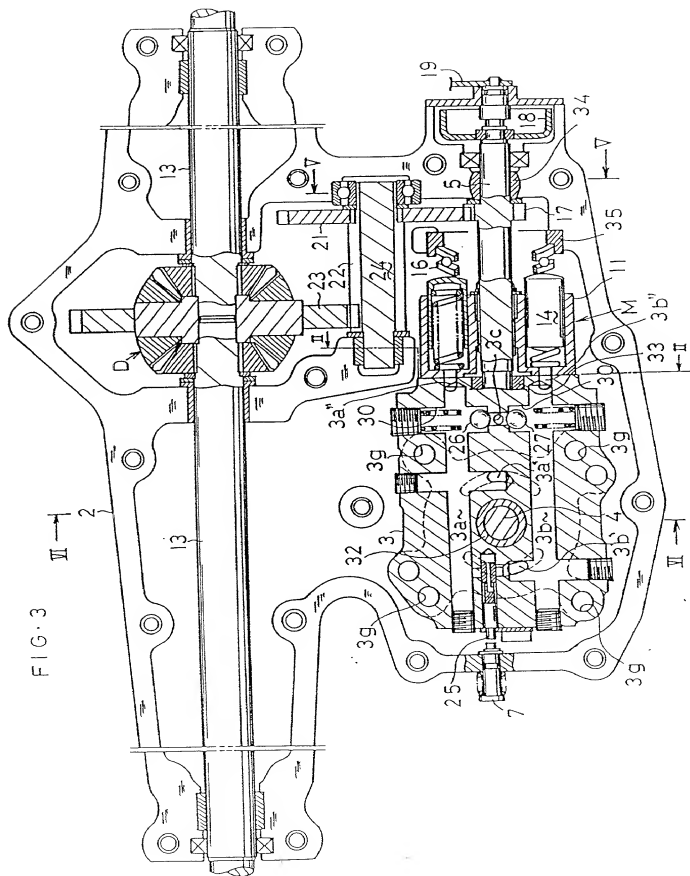


FIG. 4

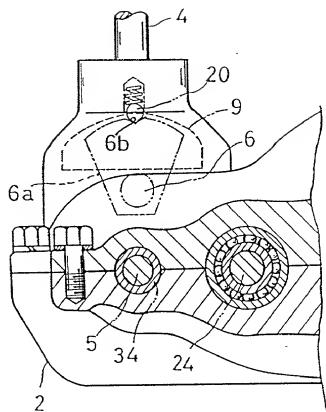


FIG. 5

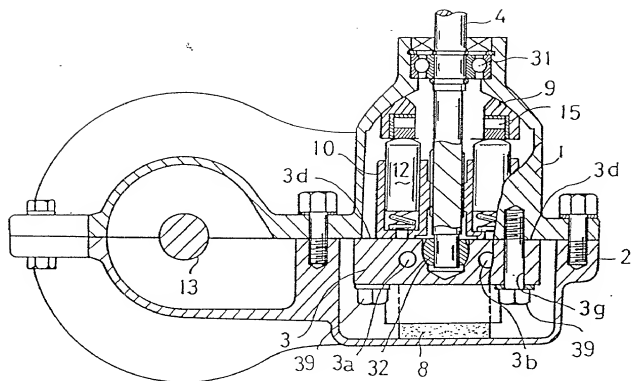


FIG. 6

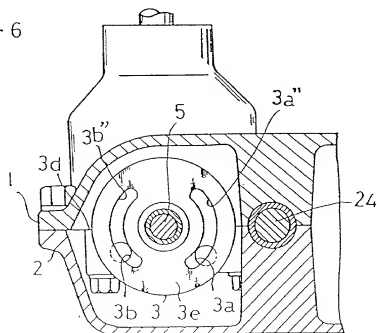


FIG. 7

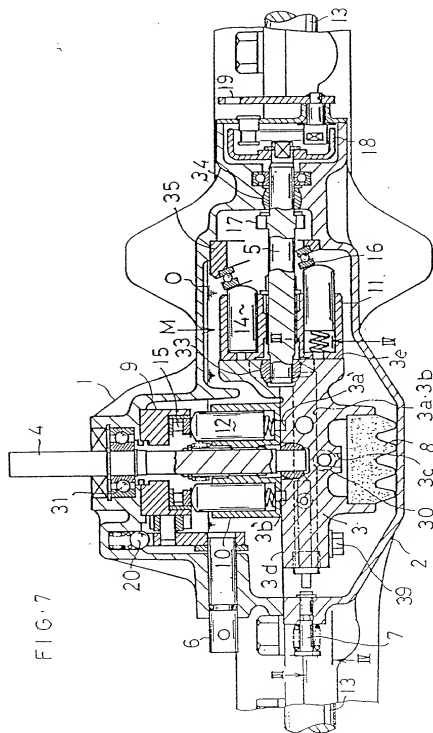


FIG. 8

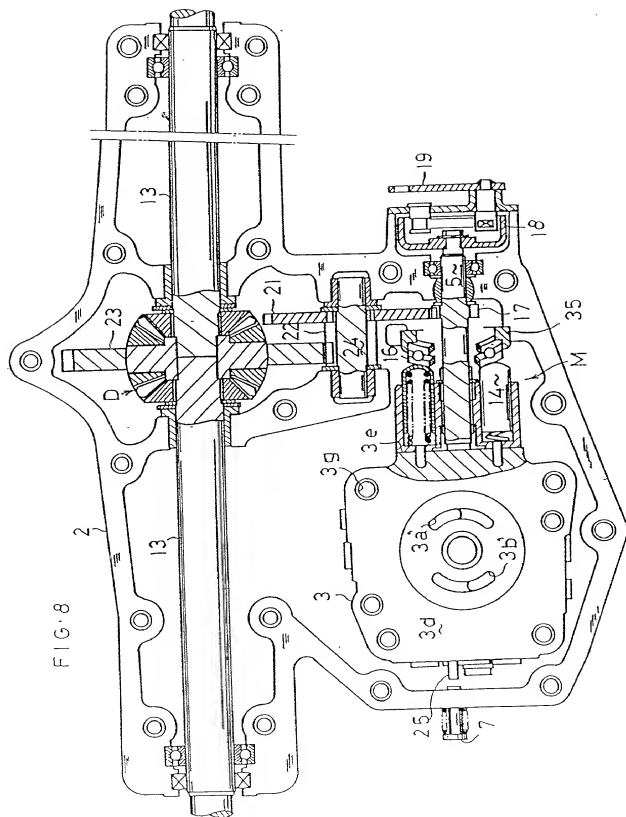


FIG. 9

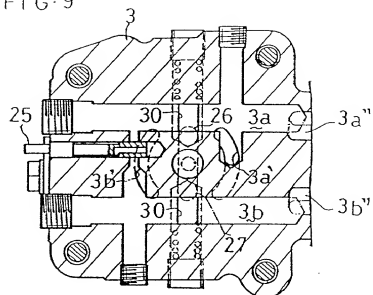


FIG. 10

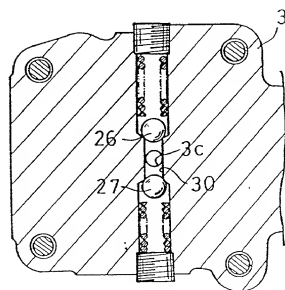




FIG. 12

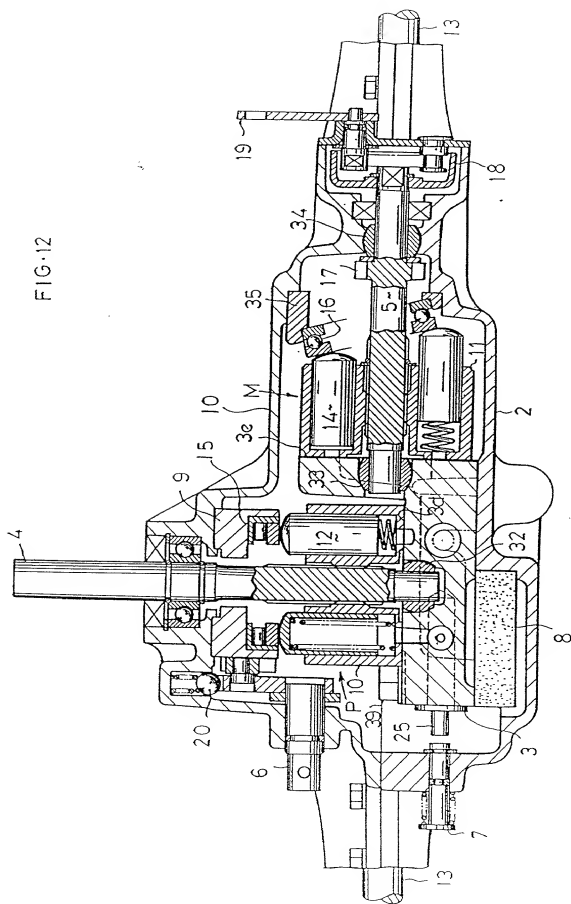
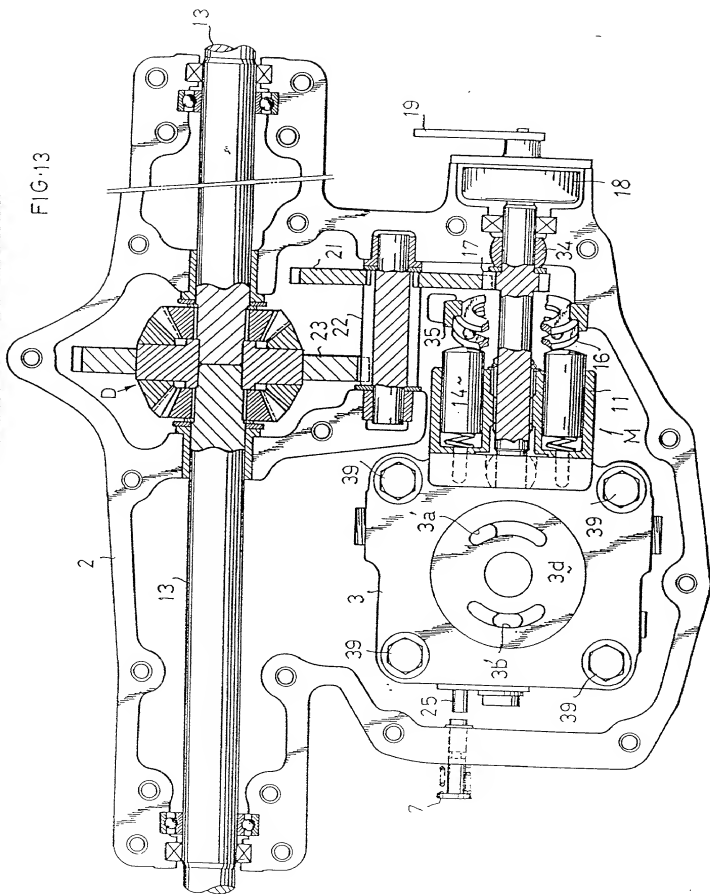


FIG. 13



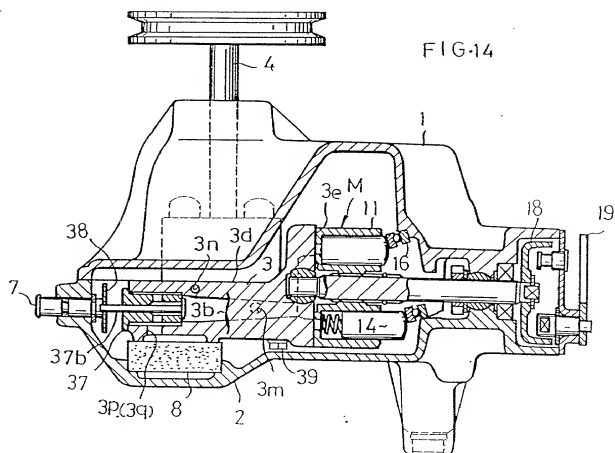


FIG. 15

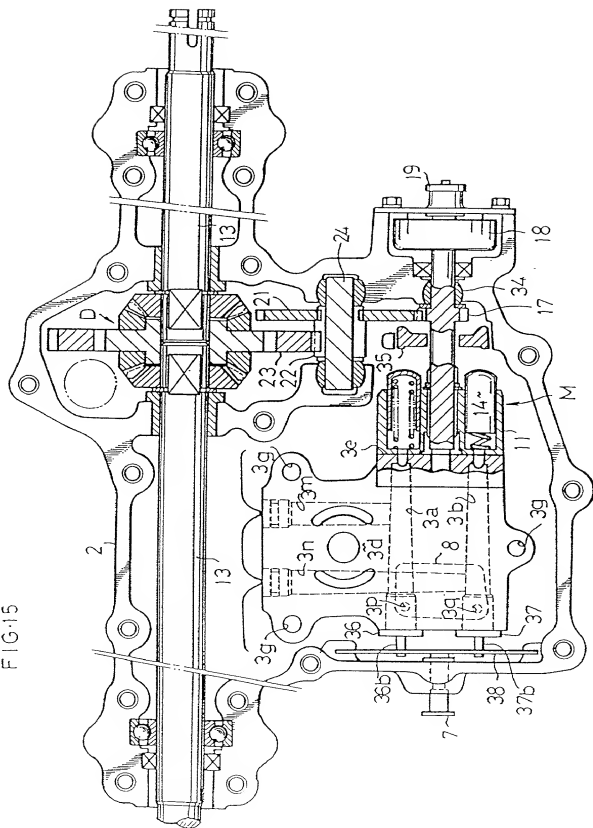
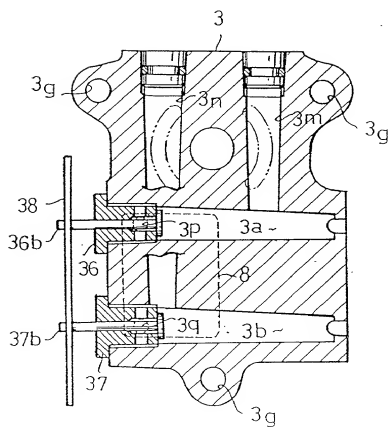


FIG. 16



### Japanese Language Declaration

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

私は、合衆国法典第35部第 1 条のもとづく下記の外国特許出願または発明者証出願の外国優先権利益を主張し、さらに優先権の主張に係わる基礎出願の出願日前の出願日を有する外国特許出願または発明者証出願を以下に明記する：

Prior foreign applications  
先の外国出願

P.63-55828	Japan	March 9, 1988
(Number) (番 号)	(Country) (国 名)	(Day/Month/Year Filed) (出願の年月日)
P.63-24193	Japan	February 3, 1988
(Number) (番 号)	(Country) (国 名)	(Day/Month/Year Filed) (出願の年月日)
U.63-79665	Japan	June 16, 1988
(Number) (番 号)	(Country) (国 名)	(Day/Month/Year Filed) (出願の年月日)
P.63-67005	Japan	March 18, 1988
(Number) (番 号)	(Country) (国 名)	(Day/Month/Year Filed) (出願の年月日)

私は、合衆国法典第35部第120条のもとづく下記の合衆国特許出願の利益を主張し、本願の請求の範囲各項に記載の主題が合衆国法典第35部第112条第1項に規定の態様で先の合衆国出願に開示されていない限度において、先の出願の出願日と本願の国内出願日またはPCT国際出願日の間に公表された連邦規則法典第37部第1章第56条(a)項に記載の所要の情報を開示すべき義務を有することを認める：

(Application Serial No.)	(Filing Date)
(出願番号)	(出願日)

(Application Serial No.)	(Filing Date)
(出願番号)	(出願日)

私は、ここに自己の知識のもとで行った陳述がすべて真実であり、自己の有する情報および信ずるところに従って行った陳述が真実であると信じ、さらに故意に虚偽の陳述等を行った場合、合衆国法典第18部第1001条により、罰金もしくは禁錮に処せられるか、またはこれらの刑が併科され、またかかる故意による虚偽の陳述が本願ないし本願に対して付与される特許の有効性を損うことがあることを認識して、以上の陳述を行ったことを宣言する。

I hereby claim \_\_\_\_\_ priority benefits under Title 35, United States Code, § 111 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Priority claimed  
優先権の主張

<input checked="" type="checkbox"/> Yes あり	<input type="checkbox"/> No なし
<input checked="" type="checkbox"/> Yes あり	<input type="checkbox"/> No なし
<input checked="" type="checkbox"/> Yes あり	<input type="checkbox"/> No なし
<input checked="" type="checkbox"/> Yes あり	<input type="checkbox"/> No なし

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

(現 況)	(Status)
(特許済み、係属中、放棄済み)	(patented, pending, abandoned)

(現 況)	(Status)
(特許済み、係属中、放棄済み)	(patented, pending, abandoned)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

委任状：私は、下記発明者として、以下の代理人をここに退任し、本願の手続きを遂行すること並びにこれに関する一切の行為を特許審判庁に対して行うことを委任する。  
(代理人氏名および登録番号を明記のこと)

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (list name and registration number)

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Edward J. KESSLER, Esq., Reg. No. 25, 688; Jorge A. GOLDSTEIN, Esq., Reg. No. 29,021

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同発明者の署名 Hideaki Okada 日付 Jan 10, 1989	Inventor's signature Date
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郵便の宛先 Same as the above residence	Post Office Address
第2の共同発明者の氏名 (該当する場合) Shusuke Nemoto	Full name of second joint inventor, if any
同第2発明者の署名 Shusuke Nemoto 日付 JAN 10, 1989	Second inventor's signature Date
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国籍 Japan	Citizenship
郵便の宛先 Same as the above residence	Post Office Address

第3の共同発明者の氏名 (該当する場合)		Full name of third inventor, if any	
同第3発明者の署名	日付	Third inventor's signature	Date
住所		Residence	
国籍		Citizenship	
郵便の宛先		Post Office Address	
第4の共同発明者の氏名 (該当する場合)		Full name of fourth inventor, if any	
同第4発明者の署名	日付	Fourth inventor's signature	Date
住所		Residence	
国籍		Citizenship	
郵便の宛先		Post Office Address	

(Supply similar information and signature for subsequent joint inventors, if any.)

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